



A.D. 1857 . . . . . N° 2026.

S P E C I F I C A T I O N

OF

EDWARD WILSON.

CONSUMPTION OF SMOKE.

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A.D. 1857 . . . . . N° 2026.

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## Consumption of Smoke.

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**LETTERS PATENT** to Edward Wilson of Worcester, in the County of Worcester, Engineer, for the Invention of “**AN IMPROVED METHOD OF CONSUMING SMOKE.**”

Sealed the 22nd January 1858, and dated the 23rd July 1857.

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**PROVISIONAL SPECIFICATION** left by the said Edward Wilson at the Office of the Commissioners of Patents, with his Petition, on the 23rd July 1857.

I, EDWARD WILSON, of Worcester, in the County of Worcester, Engineer,  
5 do hereby declare the nature of the said Invention for “**AN IMPROVED METHOD OF CONSUMING SMOKE,**” to be as follows:—

My improved method of consuming smoke consists in fixing one, two, or more tubes, as hereafter explained, in furnaces or in fire-boxes, either in a vertical, horizontal, or angular position. The tubes are made of fire clay or  
10 other suitable material, and are perforated with numerous small holes throughout their length; these holes may be at right angles, or at various inclinations to the axial line of the tubes. Air is admitted through the tubes and diffused by means of the small holes through or amongst the gases evolved from the coal during its combustion, whereby smoke is consumed or  
15 prevented. After the tubes become heated, the air enters the furnace through them in a highly rarified state. The amount of air admitted is regulated by valves or cocks.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Edward Wilson in the Great Seal Patent Office on the 23rd January 1858.

**TO ALL TO WHOM THESE PRESENTS SHALL COME**, I, EDWARD Wilson, of Worcester, in the County of Worcester, Engineer, send greeting. 5

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-third day of July, in the year of our Lord One thousand eight hundred and fifty-seven, in the twenty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Edward Wilson, Her special licence that I, the said Edward Wilson, my 10 executors, administrators, and assigns, or such others as I, the said Edward Wilson, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the 15 Channel Islands, and Isle of Man, an Invention for "**AN IMPROVED METHOD OF CONSUMING SMOKE**," upon the condition (amongst others) that I, the said Edward Wilson, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same 20 was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

**NOW KNOW YE**, that I, the said Edward Wilson, do hereby declare the nature of my said Invention, and in what manner the same is to be per- 25 formed, to be particularly described and ascertained in and by the following statement thereof, reference being had to the Drawings hereunto annexed, that is to say:—

My Invention consists in the introduction of atmospheric air, steam, or other gas or vapor into furnaces or fire-boxes of any or every description by 30 means of pipes or tubes or other suitable channels, passing into and traversing the furnace or fire-box for such a distance and to such part or parts of the furnace or fire-box as may be desired; the object of these pipes or tubes so traversing the furnace or fire-box being, in the first place, to cause the air, steam, gas, or other vapour conveyed through them to become heated to a 35 high degree; in the second place, to convey such air, steam, or other gas or vapor to such part or parts of the furnace as may be desired; and thirdly, for the minute detailed distribution of the same. The pipes or tubes are therefore

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without opening or outlet for such a portion of their length as is deemed necessary for sufficiently heating the air, steam, gas, or other vapor, and for conveying it to the situation where it is considered best to deliver it for the purpose of most effectually intercepting and thoroughly intermixing with the smoke or gases given off from the fuel. This I accomplish by making the pipes or tubes at these places with holes, slits, or other outlets, small in size but considerable in number, and varying in direction, by which the more perfect combustion of the smoke or gases of the fuel is effected.

In order that my Invention may be more clearly understood, I have annexed to this my Specification certain illustrative Drawings, which will assist in describing some of the modes in which my Invention may be carried into effect. In all the Drawings the same letters refer to the same parts.

Figures 1, 2, 3, 4, and 5, represent the fire-box of a locomotive engine in longitudinal, transverse and horizontal section. Figures 6 and 7 represent the furnace of a stationary boiler in longitudinal and transverse section. The other Figures shew matters of detail, which will be hereafter described.

*a, a*, is the inside fire box of a locomotive or other tubular boiler; *b, b*, the outside fire-box; *c, c*, the fire-bars or grate; *d, d*, the ash-pan; *e, e*, is a short pipe rivetted to the top of the fire-box, and communicating with the interior of the boiler; *f, f*, are tubes attached by brazing or otherwise to flanges *g, g*, at each end, so clustered that their outer circumferences shall be within a very small distance of each other (I prefer a sixteenth of an inch or thereabouts); and that a space *h, h*, is contained in the centre of the cluster forming a pipe or passage, either circular, elliptical, or of other convenient form. For a certain length of this pipe from the bottom flange, say about eighteen inches, the passage *h, h*, is lined with fire-clay or other suitable material in such manner as to close the spaces left between the pipes *f, f*, as before described. The top flange which is attached to the pipe *e, e*, is made with holes corresponding with the tubes *f, f*, so as to insure a free communication between the interior of the boiler and the interior of the tubes *f, f*. To the bottom flange *g, g*, is attached a pipe *i, i*, having an annular space *j, j*, communicating freely with the interior of the tubes *f, f*, and also communicating by the pipe *k, k*, with any convenient part of the interior of the lower part of the boiler, so that the water in the boiler may pass freely through the pipes *f, f*. The pipe *i, i*, has a central space *l, l*, through its whole length, forming a free communication between the passage *h, h*, and the chamber *m, m*. The bottom of the annular space *j, j*, is closed by a plate *n, n*, carrying a slide or other suitable valve *o, o*, for regulating the communication between the chamber *m, m*, and the passage *h, h*; this plate can be removed when

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required for cleaning the tubes *f, f*. For this purpose, too, it is desirable to have a blow-off cock attached to any convenient part of the annular space *g, g*. *m, m*, is an air-tight chamber which may be formed on the bottom of the ash-pan as shewn, or may be placed in any other convenient position. This chamber is supplied with atmospheric air, steam, or other gas or vapor by the 5 air pumps *p, p*, at any desired pressure, worked from the eccentrics or otherwise. The communication between the pumps *p, p*, and the chamber *m, m*, is furnished with a two-way cock, or other means of changing the supply to the chamber from the pumps *p, p*, to the atmosphere direct. Where a "donkey engine" is used, its ordinary water pump can be con- 10 verted for the time being, into an air pump by having two-way cocks or other suitable valves for shutting off the communication between the water and the boiler, and supplying the pump with air and enabling it to communicate with the chamber *m, m*, so that when the engine is not working, the "donkey" can by this means keep up the supply of air, steam, or other gas 15 or vapor required for the combustion of the smoke and other gases of the fuel, as before described.

By the foregoing description it will be seen that by the pump *p, p*, the chamber *m, m*, and the pipe or passage *h, h*, can be supplied with air, steam, or other suitable gas or vapour at any pressure, and that in passing along that 20 portion of the passage *h, h*, which is lined as before described, the air, steam or other gas or vapor must become heated, and that when it arrives where the spaces have been left between the tubes *f, f*, it will rush through these slits in every direction with a force proportioned to the pressure used, and thoroughly intermix with the smoke or gases of the fuel, and by the oxygen 25 which it conveys causing more perfect combustion; the number of these compound pipes *h, h*, may vary, there may be one, two, three, or more, as the size and requirements of the furnace or fire-box may determine. The ash-pan *d, d*, and chamber *m, m*, must be attached to the fire-box in such a way as to allow sufficient motion to meet the expansion and contraction of the 30 tubes *f, f*. It is not necessary that the air, steam, or other gas or vapor be forced into the chamber *m, m*, by air pump *p, p*, as this may be effected by fans or any other ordinary mode of moving elastic fluids. The joint of the flange *g, g*, with the tube *e, e*, being made with bolts and nuts, and the connections of the pipes *i, i, k, k*, being properly arranged, the compound pipe 35 or tube may be removed with facility when required.

The compound heating and distributing tubes may be constructed in several other ways than that described, one of which I have shown in the Drawings 3, 4, 5, 6, and 7, and it is not essential that the air, steam, or other

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gas or vapor should be forced into the chamber *m, m*, or pipe *h, h*; it may be allowed to pass uncontrolled, which I also show in the Drawings 3, 4, 5, 6, 7.

Some of these variations I now proceed to describe. *h<sup>1</sup>, h<sup>1</sup>*, Figures 3, 4, 5, 6, 7, the pipe or passage for the air, steam, gas, or other vapor is in this instance a thin tube or pipe of iron or other suitable material, perforated at such places as may be desired. Upon these tubes are placed bricks or sections *r, r*, of an outer tube, which sections or bricks may be made of fire brick, cast iron or other suitable material perforated with holes or openings to correspond with the perforations in the tubes *h<sup>1</sup>, h<sup>1</sup>*. These sections or bricks are carried by a frame *s, s*, attached to the furnace or fire-box, to which frame are firmly fitted the set pins *t, t*, upon which are fitted the flange pipes *u, u*, and held up by the cotters *v, v*, and thus support the tubes or pipes *h<sup>1</sup>, h<sup>1</sup>*, in their place. When the cotters *v, v*, are removed, the pipe *u, u*, falls and allows the tube or pipe *h<sup>1</sup>, h<sup>1</sup>*, to drop, so as to allow of the placing, replacing, or changing of the sections of the outer tube as is shewn by the position of the centre tube in Figure 4. The ends of the tubes or pipes *u, u*, communicate with the chamber *m, m*, formed in the ash-pan, the front end of which chamber is open for the admission of the atmosphere, such admission being regulated by a damper in the ordinary way.

Figures 8, 9, 10, 11, 12, 13, 14, and 15, shew in detail the parts referred to by letters.

It will be understood by reference to the letters upon the Drawings, that the foregoing description equally applies to the furnaces of stationary boilers, and it is therefore unnecessary for me to go into a more particular description as regards the application of my Invention to such stationary furnaces.

And having now described the nature of my said Invention, and in what manner the same may be performed, I declare that I claim,—

First, the introducing of atmospheric air, steam, or other gas or vapor into furnaces or fire-boxes by means of pipes or tubes or other channels passing into and traversing such furnace or fire-box, in such manner as to cause the air, gas, or vapor to be heated to a high degree, before coming in contact with the smoke or gases evolved from the fuel in the furnace.

Second, the detailed distribution of the air, gas, steam, or vapor so heated in such manner as to insure its thoroughly intercepting and mixing with the gases given off by the fuel, for the better combustion of the same.

Third, the peculiar modes of constructing the pipes or tubes for conveying, heating, and distributing the air, gas, or vapor for facilitating their renewal in small sections, and for the better preserving them from deterioration by the action of the fire, all as herein-before described.

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Fourth, the making of the said pipes or tubes movable, to prevent their interfering with the accessibility of the tubes and other parts of the furnace or fire-box.

Fifth, the introduction of a jet of steam or other elastic fluid into and through or between each or any of the pipes or tubes before named. 5

Sixth, the forcing by artificial means either by fan, air pump, or other contrivance, a large quantity of air or other elastic fluid into a chamber, from which chamber it can be supplied at pleasure to the heating and distributing tubes before named, or forcing the air or other elastic fluid direct into the tubes or pipes before described, without the intervention of such chamber. 10

Seventh, the employment of one or more of the water pumps used about an engine as air pumps, whether such pumps are worked by the engine itself, or by a supplementary "donkey engine" as is sometimes done.

Lastly, the general arrangement and construction of pipes, tubes, jets, pumps, fans, air chambers, &c. as herein-before described and represented in 15 the Drawings annexed.

In witness whereof, I, the said Edward Wilson, have hereunto set my hand and seal, this Twenty-first day of January, One thousand eight hundred and fifty-eight.

EDW. WILSON. (L.S.)

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LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1858.

FIG. 1.

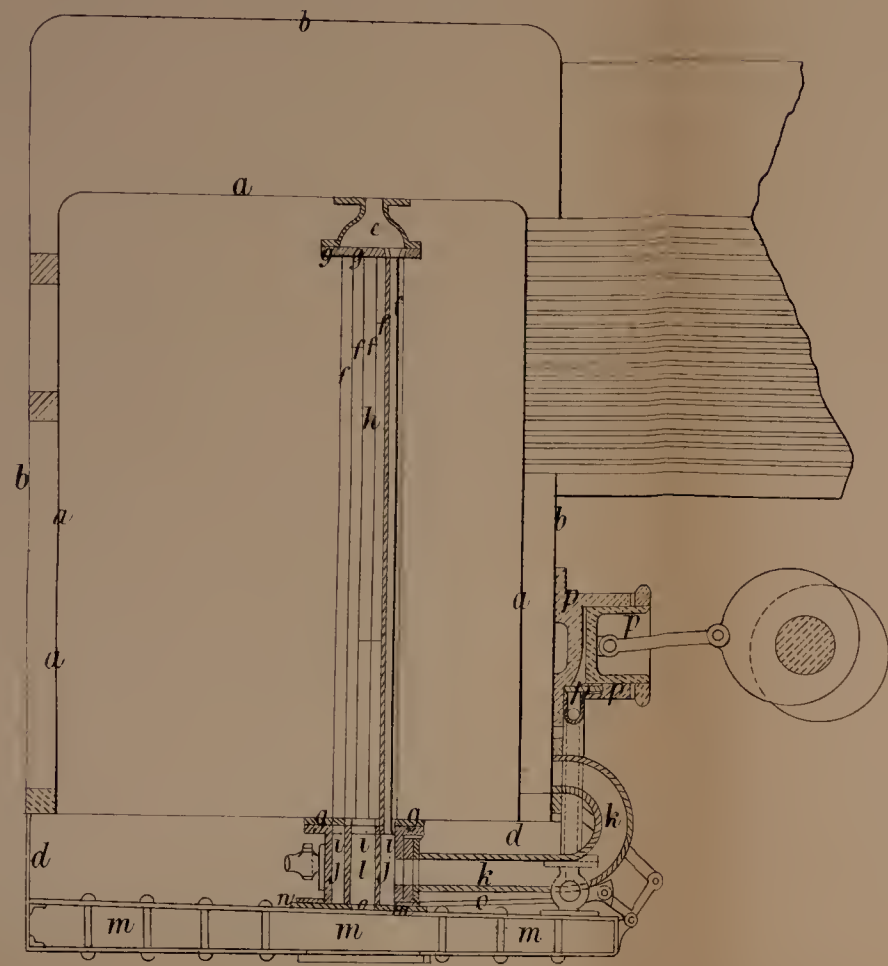


FIG. 3.

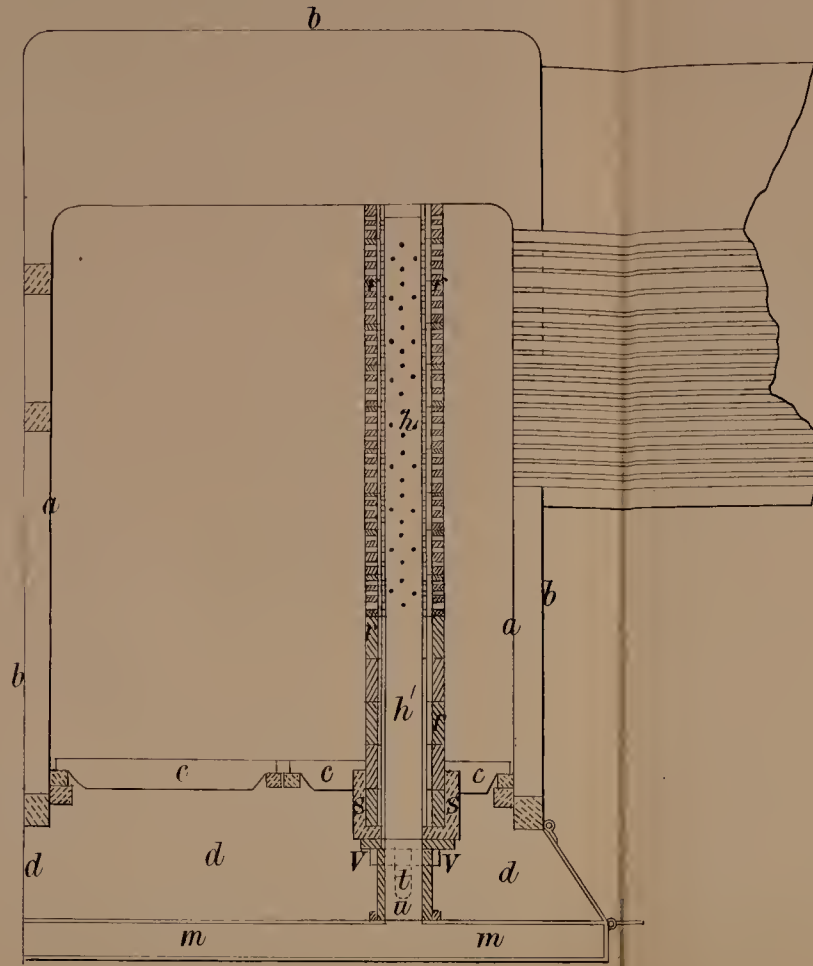


FIG. 4.

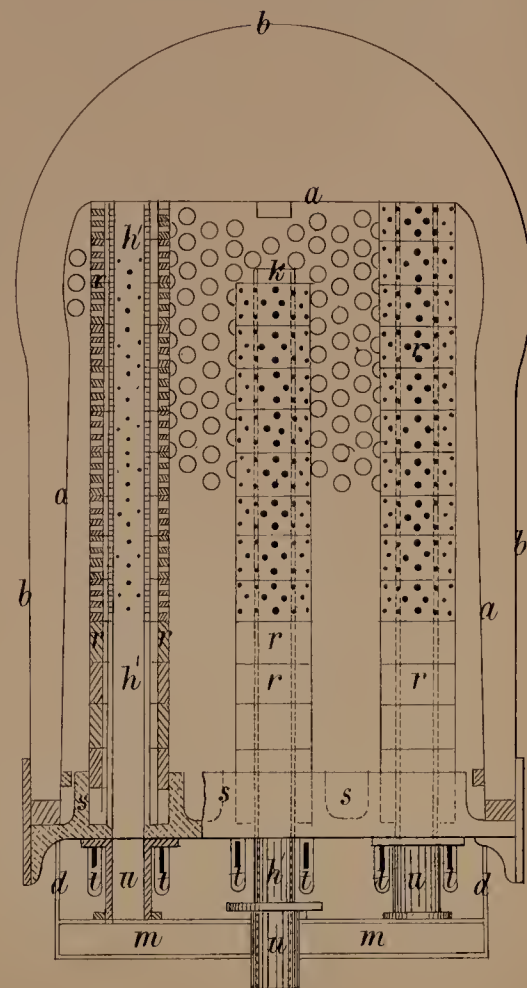


FIG. 6.

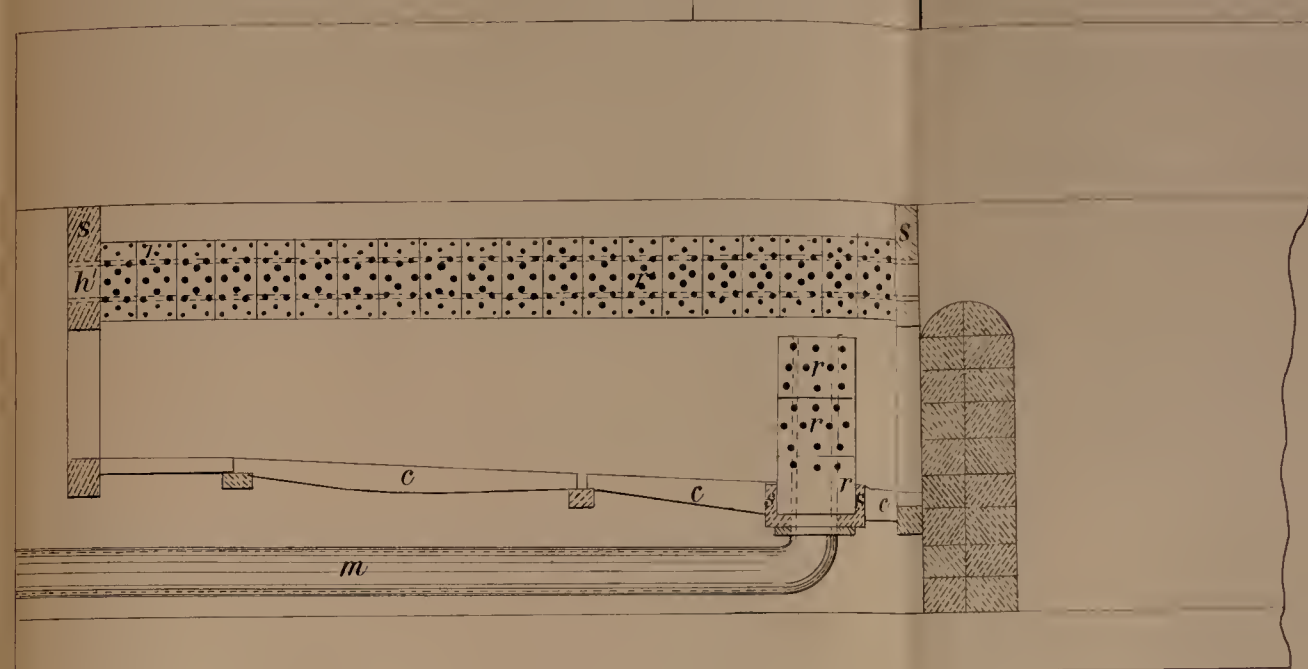


FIG. 2.

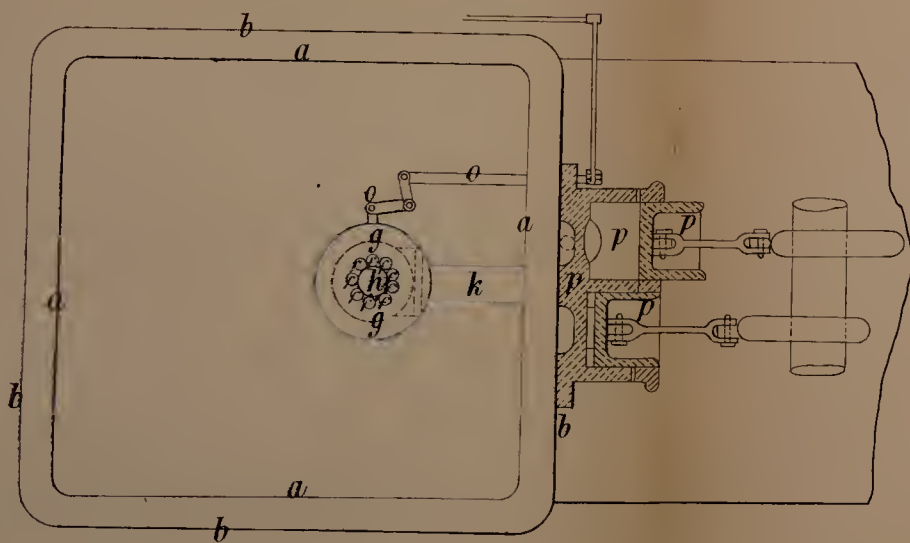


FIG. 5.

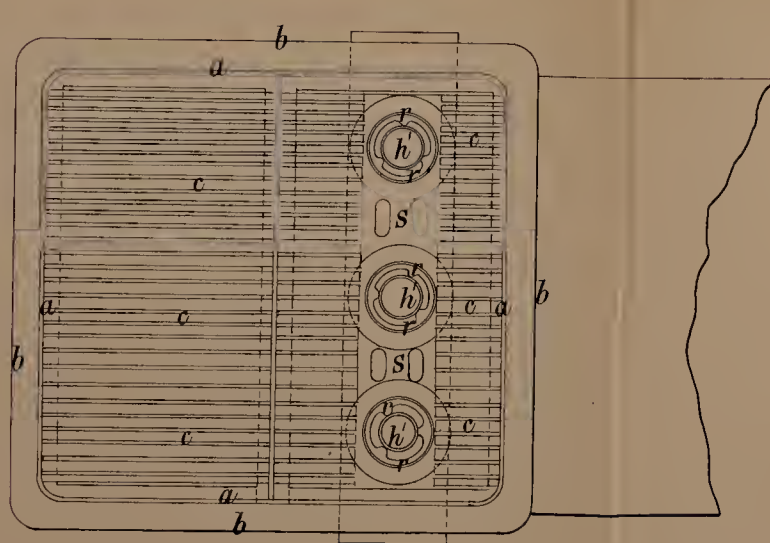


FIG. 12.

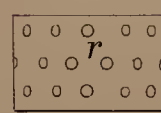


FIG. 13.

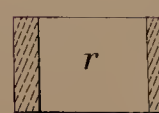


FIG. 14.

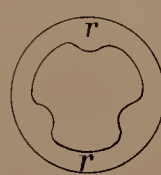


FIG. 15.

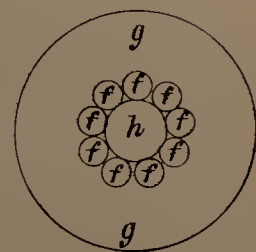


FIG. 9.

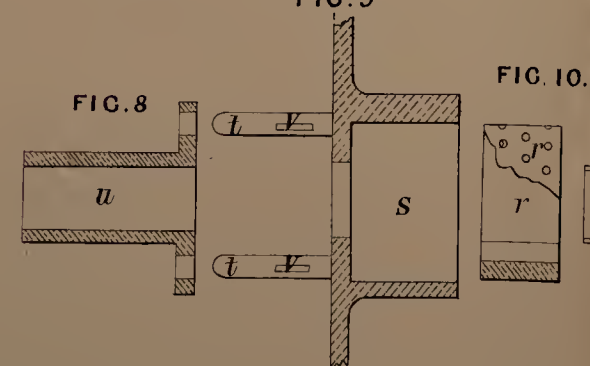


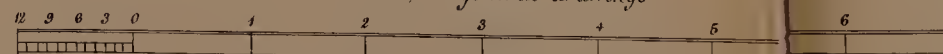
FIG. 10.



FIG. 11.



Scale of general drawings



Scale of details

